Hydrodynamic simulations of an imploding bubble. William C. Moss, Douglas B. Clarke, John W. White and David A. Young (Lawrence Livermore National Laboratory, Livermore, CA, 94551)

Numerical solutions of the hydrodynamic equations of motion for a collapsing bubble have shown that shock waves can be generated during the collapse. It has been shown that these shock waves can supply and remove energy from the center of the bubble rapidly enough to account for the picosecond duration flashes that are observed experimentally. However, these solutions have not included energy loss mechanisms, so the calculated temperatures are excessively high. We discuss more accurate numerical simulations that (i) model the shocked gas as a plasma with distinct ion, electron, and radiation temperatures, and (ii) include energy losses by ion conduction, electron conduction, and radiant energy transport. As an example, we consider a sonoluminescing bubble of deuterium, whose sinusoidal driving amplitude is enhanced by a small pressure spike. Although the calculated radiation and electron temperatures are only tens of eV, the calculated peak ion temperatures are a couple hundred eV (≈2,000,000 K) which may be sufficient to initiate a very small number of thermonuclear reactions at the center of the bubble. This work was performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

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